
**NEED ANALYSIS OF NUMERICAL LITERACY ASSESSMENT
DEVELOPMENT FROM MATHEMATICAL LEARNING OUTCOMES SEEN
FROM PEDAGOGICAL PERSPECTIVES**

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ABSTRACT

The results of the Program for International Student Assessment (PISA) on a regular basis which have implications for the Computer-Based National Assessment Program (ANBK) which have been implemented by the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia in 2021, make the improvements to the mathematics learning assessment instrument through findings from the field test results are considered important to be carried out. This study aims to describe the need for a Numerical Literacy Assessment of Mathematics Learning Outcomes which trains five competencies in learning mathematics, namely problem solving, communication, reasoning, connection, and representation by considering pedagogical study. This study involved 10 teacher respondents from several regions in Indonesia. The instruments of this research are a questionnaire and an observation guide to the evaluation of mathematics learning outcomes made by teachers which have been validated by two pedagogic experts and a mathematician. The questionnaire was distributed openly through the Google form application. The questionnaire data was processed qualitatively, followed by data reduction, data presentation, discussion and discussion and conclusions. The results of this study include the evaluation instruments made by the teacher were still dominated by multiple choice questions and objective descriptions, which were 80 and 85% respectively and the finding of the need for improvement mathematical representation and connection competence at the 45% level. In relation to pedagogy, this needs analysis is considered necessary because the four aspects of evaluation are considered important to be applied.

Kata kunci: Asesmen Literasi Numerical Literacy Assessment, Mathematical Literacy, Pedagogical Study, Development Research.

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INTRODUCTION

Mathematical literacy ability is related to how individuals can apply knowledge in real-world problems, so that the benefits can be felt directly (Indrawati, 2020). It can be said that mathematical literacy can make it easier for students to find out more about the role of mathematics in everyday life. Mathematics is one of the exact fields of science that is more concerned with students' understanding than memorization.

Surveys of students' learning outcomes such as the Program for International Student Assessment (PISA) which indicate the quality of education are present to measure literacy skills, including numerical literacy in each member country. Given this phenomenon, it is important to improve the assessment instrument for learning mathematics through the findings obtained from the results of the field test. This is an important implication for students' motivation and engagement as well as their course evaluation (Howley, 2020).

Given the importance of mathematical literacy skills, efforts are needed in order to develop these abilities. Education in this case mathematics education has an important role in making it happen (Sari, 2015). This embodiment can be in the form of a follow-up to the results of the evaluation of mathematics learning so that the evaluation provides an assessment of the sustainability of learning and provides an overview of what the teacher needs to display in the next lesson. In addition, Dasaprawira et al. (2015) added that PISA-based questions are used to familiarize students with contextual problems in everyday life that can be solved mathematically and improve students' literacy skills.

The National Council of Teachers of Mathematics (2000) stated that there are five competencies in learning mathematics, namely problem solving, communication, reasoning, connection, and representation. The combination of these five competencies needs to be possessed by students in order to be able to use mathematics in everyday life. The ability that includes the five competencies is mathematical literacy ability (Aritonang & Safitri, 2021).

The assessment instrument can be developed from the evaluation instrument. According to Amiriono (2016), there are several forms of evaluation in the assessment, including diagnostic, formative, and summative evaluations. In this case, the evaluation needs to be focused on literacy-based matters because there are students who still have difficulty answering PISA-type questions because they may not be familiar with contextual problems (Pratiwi et al., 2020).

Teacher pedagogic competence will be realized in the form of mastery of skills, knowledge and attitudes in carrying out their duties and functions as teachers, so that the goals and demands in carrying out learning activities can be achieved properly and can evaluate learning in accordance with what is expected (Supratman et al., 2020). In pedagogic studies, development in the field of education needs to be carried out

because these competencies will be realized in the form of mastery of skills, knowledge and attitudes in carrying out their duties and functions as teachers, so that the goals and demands in carrying out learning activities can be achieved properly and can evaluate learning in accordance with What is expected is that students need to be trained to seek, find, process, and use information independently (Purba et al., 2021).

METHOD

This research was conducted using descriptive analysis method which is part of qualitative research. The technique used in data acquisition is through the technique of collecting questionnaires and observations.

Questionnaires are data collection techniques that are carried out through giving a set of questions or written statements to respondents to be answered (Sugiyono, 2016). The questionnaire is suitable to be given if the number of respondents is large enough and spread over a wide area. Questionnaires can be in the form of closed or open questions given directly or through communication media. In this study, the researcher first asked for validation from two people and three validators, one of them from experts on pedagogic concepts, learning effectiveness, and mathematics learning. The researcher tries to give a questionnaire through a Google form. Respondents were also asked to upload a sample of the evaluation instrument that had been made and used as research material for observations.

The questionnaire was deemed suitable to be given because the number of respondents was quite large and spread over a wide area. Questionnaires can be in the form of closed or open questions given directly or through communication media (Sugiyono, 2016). In this study, the researcher first asked for validation from two people and three validators, each of them from experts on pedagogic concepts, learning effectiveness, and learning mathematics. The researcher tries to give a questionnaire through a google form or google form. Respondents were also asked to upload a sample of the evaluation instrument that had been made and used as research material for observations. The 20 respondents represented supplementary factors that met saturation in qualitative research (Mason, 2010). The data and responses from respondents are presented in Table 1 below:

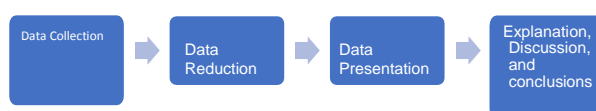
Table 1. The Information of Respondents' Background

Teachers' Identity	Variables	Frequencies	Percentage
Employment Status	Civil Servant	12	60%
	Non-Civil Servant	8	40%
Teaching Experiences	0 – 5 years	13	65%
	6 – 10 years	2	10%
	> 10 years	5	25%
<u>Profession</u>	Have not been a Teacher Profession	12	60%
<u>Program</u>	Education (PPG) participant		
	Have been through the PPG Program	8	40%
Classes	Low Classes	18	90%
	High Classes	2	10%
School Names	SDIQ Darul Huffaz, Banda Aceh, Aceh	1	5%
	SD Negeri 23 Ranah, Padang, Sumatera Barat	1	5%
	SD Hang Nadim Malay School, Batam, Kep. Riau	1	5%
	SDN 175/X Kandis Dendang, Tj. Jabung Timur, Jambi	1	5%
	SD Muhammadiyah 6 Palembang, Sumatera Selatan	1	5%
	SD Negeri 36 Palembang, Sumatera Selatan	1	5%
	SD Negeri 58 Palembang, Sumatera Selatan	1	5%
	SD Negeri 75 Palembang, Sumatera Selatan	1	5%
	SD Negeri 77 Palembang, Sumatera Selatan	1	5%
	SD Negeri 4 Koba, Bangka Tengah, Bangka Belitung	1	5%
	SDIT Asy-Syukriyyah, Tangerang, Banten	1	5%
	SD Negeri Cempaka Putih Barat 15, Jakarta Pusat, DKI Jakarta	1	5%
	SD Negeri 053 Cisitu, Bandung, Jawa Barat	1	5%
	SD Negeri 3 Tugu, Tasikmalaya, Jawa Barat	1	5%
	SD Negeri Wonoharjo 1, Pangandaran, Jawa Barat	1	5%
SD Islam Ummuna, Blora, Jawa Tengah	1	5%	

	SD Negeri Lempuyangwangi, Yogyakarta, DIY	1	5%
	SD Negeri 1 Tumbang Kania, Kotawaringin Timur, Kalimantan Tengah	1	5%
	SD Negeri Wee Muu, Sumba Barat Daya, NTT	1	5%
	SD Inpres Barakkang, Mamuju, Sulawesi Barat	1	5%
School Status	Public	15	75%
	Private	5	25%

The data that have been collected will be analyzed and through data processing procedures according to Miles and Huberman in Sugiyono (2016) which is illustrated in Chart 1 below:

Chart 1. Data Processing Procedures



RESULTS AND DISCUSSIONS

The Analysis of the Respondents' Answers in Using Evaluation

The questionnaire answers regarding the use of the evaluation test items types are commonly used when evaluating mathematics learning. The answers to this questionnaire consist of types of objective test questions. Objective test is a written test that requires students to choose the answers that have been provided or give short answers and the examination is carried out objectively (uniformly) on all students. There are several types of objective form tests, namely: multiple choice, true false choice, matchmaking, and short entry. In addition to anticipating the use of alternative types of evaluations that have been used by teachers, researchers provide alternative types of open-ended and portfolio. Open-ended questions are questions used by students to explore further answers than closed-ended questions (Reja et al, 2003) while portfolio assessments can be used to improve students' abilities through feedback assessment and self-assessment (Reja et al, 2003). Kuntarto & Gustina, 2019). Respondents are allowed to give more than one answer according to their experience in evaluating mathematics learning.

Table 2. The Respondents' Answers in Using Evaluation Items Types

Questions	Answers and Their Percentage	
What evaluation items types do you usually give to the students on the focus of learning Mathematics?	Multiple Choices	80%
	True or False	40%
	Objective	85%
	Description	
	<i>Open-Ended</i>	35%
	Portfolio	35%

From the table of respondents' answers to the use of the types of evaluation items, it is known that the questions items types often made by the respondents are multiple choices and objective descriptions, each of which has a percentage of 80% and 85%. According to Rohim (2019), multiple choices are used in the preparation of questions based on high order thinking skills (HOTs) also used by PISA in the testing model.

The analysis of the Respondents' Answers on Mean Scores with Daily Evaluation Instruments

The researchers also asked questions about the students' mean score after being evaluated by preparing a range of five ranges including 15 - 27, 28 - 47, 48 - 67, 68 - 87, and 88 - 100. The majority of 60% of respondents stated that their mean score in the evaluation of mathematics learning was in the range of 68 - 87 while 30% of them stated that their mean score in the evaluation of mathematics learning was in the range of 48 - 67. One respondent stated that the mean score in the evaluation of learning mathematics was in the range of 88 - 100 and one another respondent informs that his students were in the range of 28 - 47 on the average evaluation of mathematics learning.

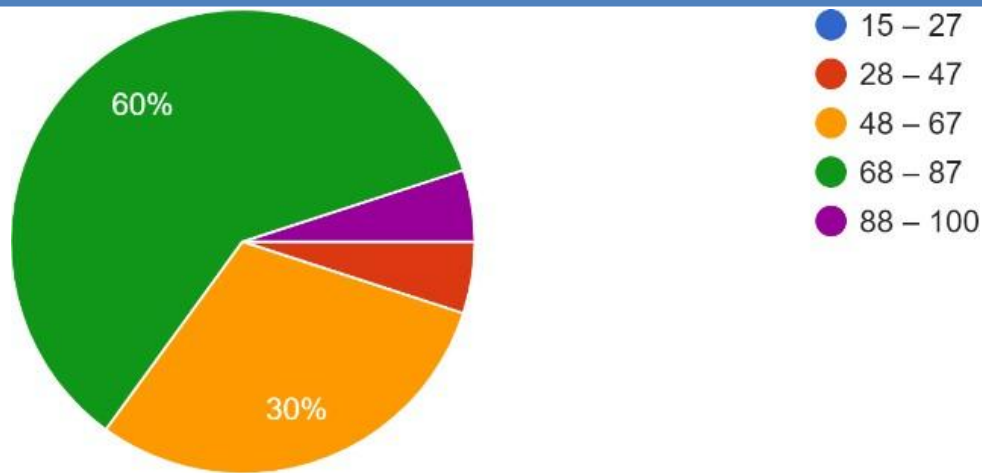


Diagram 1.

The Variety of the Students' Mathematics Learning Evaluation Results Mean Score

The Analysis of the Respondents' Understanding of Development of Evaluation Instruments for Assessment

The next question aimed to explore the respondents' opinions with the question "Do you think the evaluation instrument that you have created can be used as an assessment of numerical literacy?" where 16 people or 80% of respondents said **they could** and 4 other respondents thought **they could not**. This question is related to the next question, namely "If in your previous answer you answered **yes**; what is the content in the evaluation instrument that makes you think that the evaluation instrument you created can be a numeracy literacy assessment instrument? If in your previous answer you said **you cannot**, what do you think needs to be added to the evaluation instrument so that it becomes a numerical assessment instrument? The findings obtained were that the four respondents thought that the evaluation instrument could not be used as an assessment of numerical literacy answered with their respective reasons; "Because of the lack of scoring," "It needed to be adjusted so that the development of the evaluation/question language becomes a numerical literacy assessment accompanied by exercises in the learning process so that the students could interpret the meaning contained in the assessment," "it is better to make a format for the numerical assessment complete with instructions for use.," and "Need an introduction to the instrument in the form of a story or reasoning."

The researchers also asked each respondent's understanding of the five

mathematical competencies and provided four alternative answers including *Absolutely Understand* (AU) if the respondents felt that they understood the mathematical competence being asked very well, *Understand* (U) if the respondents knew and understood the mathematical competence in question, *Do Not Understand* (DNU) if the respondent did not know clearly about the mathematical competence being asked, and *Absolutely Do Not Understand* (ADNU) if the respondents turned out to have just heard the term mathematical competence being asked. The research findings were on the question of the first four mathematical competencies, namely problem solving, reasoning, connection, and mathematical communication, the respondents only answered the two alternative answers "Understand" or "Do not understand" while on the last mathematical competence, namely mathematical representation, there were respondents who answered very well so that there were three alternative answers chosen by them.

Table 3.

The Responses from Respondents about Understanding Mathematics Competence

No	Do you Understand about?	<u>The Respondents'</u> <u>Answers</u>			
		AU	U	DNU	ADNU
1	Mathematical Problem-Solving	-	85%	15%	-
2	Mathematical Communication	-	70%	30%	-
3	Mathematical Reasoning	-	80%	20%	-
4	Mathematical Connection	-	55%	45%	-
5	Mathematical Representation	5%	50%	45%	-

Following up on the results from the table above where there were still many respondents who felt the need to improve their assessment of mathematical and representative connections, both of which were at the 45% level, then these two aspects were considered the most important to be developed.

The Analysis of Respondents' Evaluation Instruments Used

The researchers invited the respondents to carry out an independent diagnosis of the instruments used by them in daily teaching related to the five mathematics

competencies and there are four alternative answers including *Strongly Agree* (SA) if they felt that the evaluation instrument used is specifically for everyday mathematics learning. contains the intended mathematical competence; *Agree* (A) if they felt that the evaluation instrument used in learning mathematics contains the mathematics competence in question, although not every evaluation; *Disagree* (D) if they felt that the evaluation instrument used in daily learning does not contain the mathematical competence required referred to, and *Strongly Disagree* (SD) if they turned out to have just heard the term mathematical competence being asked.

Table 4.
The Respondents' Responses on Evaluation Instruments Used and Its Relation to Mathematics Competence

No	Questions	<u>The Respondents' Answers</u>			
		SA	A	D	SD
1	The evaluation instrument that I created assesses mathematical problem solving skills	25 %	65 %	10 %	-
2	The evaluation instrument that I created assesses mathematical communication skills	10 %	60 %	30 %	-
3	The evaluation instrument that I created assesses the ability of mathematical reasoning	25 %	65 %	10 %	3
4	The evaluation instrument that I made assesses mathematical connection ability	10 %	80 %	10 %	4
5	The evaluation instrument that I made assesses mathematical representation ability	15 %	65 %	20 %	5

The Analysis of Numerical Literacy Assessment from the Perspective of Pedagogic Studies According to the Respondents

The researchers conducted a survey asking for the opinions of the teachers who have pedagogical competence to analyze whether the development of a numerical

literacy assessment of the mathematics learning evaluation instrument was in accordance with the pedagogical perspective. As a result, the respondents answered only the answer choices *Strongly Agree* (SA) and *Agree* (A) for the four statements. This was evidenced by 30% of respondents answered *Strongly Agree* and 70% responded with *Agree* response to the first and second statements. In the third statement, half or 50% of respondents responded *Agree* and the other 50% answered *Strongly Agree*. In the fourth statement, 60% of respondents saying *Strongly Agree* and 40% said *Agree*.

Table 5.
The Responses to the Numerical Literacy Assessment from the Perspective of Pedagogic Studies According to the Respondents

No	Statements	The Respondents' Answers			
		SA	A	D	SD
1	In my opinion, numerical literacy assessment should refer to the important emphasis on objectivity in the evaluation process	30 %	70 %	-	-
2	In my opinion, a numerical literacy assessment needs to be checked for conformity between educational goals and learning outcomes achieved	30 %	70 %	-	-
3	In my opinion, the assessment of numerical literacy needs to be carried out continuously during the process of implementing the ongoing curriculum	50 %	50 %	-	-

CONCLUSION

From the results and discussion above, it is known that the respondents who represent the pedagogic competencies of all teacher resources have not yet integrated the mathematical competencies needed in the 21st century in the evaluation instrument. In line with this, to answer global challenges, it is necessary to have an

assessment instrument that provides an overview of the sustainability of further learning which is judged to have no problems from the pedagogic review because none of the respondents responded *Disagree*. As a preliminary study of research and development, this research can serve as an illustration for developmental researches that will be carried out in the future, especially RnD research.

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